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Oral language predictors for the at-risk reader: A review

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Abstract

The importance of early identification of at-risk readers has received attention in recent literature. This paper reviews evidence for oral language components, shown to have predictive capacity to identify at-risk readers at an early age. Both phonological and non-phonological components of oral language difficulties are linked to poor reading outcomes in a majority of children. At-risk preschoolers may present with phonological deficits, sub-clinical or clinical language impairment. The nature and importantly the trajectory of reading difficulty will vary, depending on the area of language breakdown. Irrespective, difficulty with reading comprehension is likely to result. Importantly, the variation in the trajectory of reading difficulty means that some children may struggle during the initial phases of learning to read, whereas others may experience initial success, but encounter difficulties at a later point when reading demands increase. Clinical implications for speech-language pathology assessment practices and ongoing monitoring of oral language and reading skills are discussed.

Keywords: *At-risk reader, double-deficit hypothesis, phonological-core-deficit hypothesis, phonological processing, rapid automatic naming, specific comprehension deficit.*

Introduction

It is widely agreed that reading is a language-based skill (Catts, Fey, Zhang, & Tomblin, 1999; Catts, Fey, Tomblin, & Zhang, 2002; Catts & Kamhi, 2005; Nation, Clarke, Marshall, & Durand, 2004; Paul, 2007; Van Kleeck, 2007). Links between many aspects of oral language and reading achievement have been well established for some time (Bradley & Bryant, 1983; Catts et al., 1999, 2002; Fletcher et al., 1994; Georgiou, Parilla, & Kirby, 2006; Goswami & Bryant, 1990; Stuart, 2005; Tunmer & Chapman, 2007; Vellutino, Scanlon, Small, & Tanzman, 1991). Further, it has been demonstrated that oral language capacity prior to school entry, substantially contributes towards predicting reading achievement once formal instruction commences (Boudreau & Hedberg, 1999; Catts et al., 1999, 2002; Paul, 2007; Justice, Invernizzi, & Meier, 2002; Plaza & Cohen, 2007; Snowling, Bishop, & Stothard, 2000; Vellutino et al., 1991). Stuart (2005) draws attention to the simple yet critical fact that the language system is the starting point for pre-reading children to begin accessing information to make sense of print.

In this paper, we review and explore the evidence for language-based processes that underpin reading, with a particular emphasis on reading difficulty.

We use this evidence to focus on the language predictors that can identify young children who are at-risk for reading difficulty. We include the components of phonological processing to discuss the phonological predictors whereas we focus primarily on grammatical and semantic dimensions of oral language to cover the non-phonological aspects. Our aim is to provide speech-language pathologists and related colleagues with evidence-based information to guide language assessment practices that in turn enable the identification of preschool and early school aged children, at risk of progressing to difficulty with reading. Before exploring the evidence for language predictors of reading difficulty, we present the overall case for early identification for at-risk readers.

Early identification of at-risk readers

Early identification of at-risk readers has attracted much attention in recent literature (Boudreau & Hedberg, 1999; Catts et al., 1999; Catts, Fey, Zhang, & Tomblin, 2001; Gilbertson & Bramlett, 1998; McNamara, Scissons, & Dahleu, 2005; Pikulski, 1994; Simpson & Everatt, 2005; Snowling et al., 2000; Torgesen, 1998). We define the at-risk reader as the preschool or early school aged child who is

displaying signs that are potentially predictive of difficulty when being taught to read. Early identification adopts a prevention focus rather than a remediation focus (Torgesen, 1998). Importantly, many argue that a prevention model will help reduce the incidence of children with severe reading difficulties (Catts et al., 2001; Gilbertson & Bramlett, 1998; Jenkins & O'Connor, 2002; Snow, Burns, & Griffin, 1998). Although predictors are simply correlates rather than causes, this repeated focus in the literature cannot be ignored.

The importance of early identification and intervention

In 1986, Stanovich described the “Matthew Effect” phenomenon in relation to poor readers such that those who start out as poor readers, typically remain so (Torgesen, 1998). Spira, Bracken, and Fischel (2005) strengthened the case for early detection and intervention when asserting that by third grade, reading ability is likely to remain largely stable. Poor long-term personal and social outcomes are also widely reported in connection with poor reading ability (De Walt, Berkman, Sheridan, Lohr, & Pignone, 2004; Lyon, 2003; Naylor, Staskowski, Kenney, & King, 2004; Pikulski, 1994; Snow & Powell, 2004; Swanson, Hodson, & Schommer-Aikins, 2005). Moreover, substantial evidence exists reporting benefits of early intervention programmes compared to remedial programmes offered at a later stage (Bradley & Bryant, 1993; Elbaum, Vaughn, Tejero Hughes, & Moody, 2000; Pikulski, 1994; Slavin et al., 1996; Snow et al., 1998; Van Kleeck, Gillam, & McFadden, 1998). Elbaum et al. (2000) demonstrate the benefits of early intervention for reading difficulty in their meta-analysis, by highlighting the significance of grade level as a variable in treatment effects. Taken together, many factors combine to highlight the importance of early and accurate identification of the at-risk reader.

In the following section, we briefly discuss the evolution of classification systems for reading difficulty. We specifically highlight the Simple View of Reading (SVR) as the model of choice as a means of discussing language predictors. The SVR was initially documented by Gough and Tunmer (1986) and updated with substantial empirical evidence by Hoover and Gough (1990). The SVR was chosen because it allows for consideration of the unique contributions of both phonological processing and oral language processing as foundations for reading comprehension, as documented by a number of authors (Cain, Oakhill, & Bryant, 2000; Catts et al., 1999, 2001; Catts, Adlof, & Ellis Weismer, 2006; Dreyer & Katz, 1992; Gilbertson & Bramlett, 1998; Gough & Tunmer, 1986; Hoover & Gough, 1990; Stuart, 2005; Tomblin, Zhang, Buckwalter, & Catts, 2000; Vellutino et al., 1991). Van Kleeck's (2007) model for pathways to reading comprehension is more detailed than the SVR, particularly in highlighting the importance of inferential and literate oral language. Nevertheless, her model is similarly underpinned by phonological and non-phonological aspects of oral language that work in parallel towards reading comprehension competency.

Background to classification of reading difficulty

The discrepancy definition model

For many years, the discrepancy definition model was used to classify reading ability in children (Rutter & Yule, 1975). The discrepancy definition implies that a specific reading difficulty exists when there is a discrepancy between reading achievement and general achievement (Catts & Kamhi, 2005; Snow et al., 1998; Stanovich, 1999). Figure 1 displays this classification along with the terminology applied to the discrepancy definition.

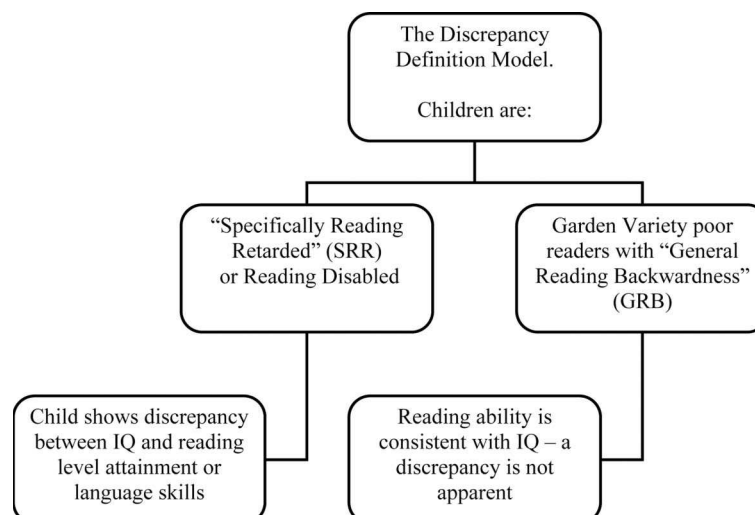


Figure 1. Classification of reading disability based on the Discrepancy Definition Model (Rutter & Yule, 1975).

The shift away from the discrepancy definition model

The discrepancy definition was considered valuable as a prognostic indicator since the Specifically Reading Retarded group were considered to have more potential for gains based on their higher IQ compared to children classified with general reading backwardness (Catts & Kamhi, 2005). More recently, however, the discrepancy definition has fallen out of favour as a model for classifying reading disorders and determining candidacy for intervention (Betourne & Friel-Patti, 2003; Catts & Kamhi, 2005; Fletcher et al., 1994; Siegel, 1989; Stanovich, 1999). Various researchers established that IQ was in fact not a strong predictor of reading outcomes following intervention (Torgesen, Wagner, & Rashotte, 1997; Vellutino, Scanlon, & Lyon, 2000). Rather, the substantial evidence gained over the last 20 years about the importance of phonological processing in reading, has been instrumental in challenging the discrepancy definition. Weakness in processing the phonological features of language, regardless of general achievement, is now viewed widely as a core feature of word reading difficulties (Betourne & Friel-Patti, 2003; Fletcher et al., 1994; Liberman, Shankweiler, & Liberman, 1989; Share & Stanovich, 1995; Siegel, 1989; Stanovich, 1986; Torgesen, 1998).

Importantly, Stanovich (1999) makes the point that no evidence to date suggests that children with low or high IQ scores respond differently to intervention to support reading difficulty. IQ was however a key determinant for remedial reading services when the specific reading retardation and general reading backwardness groupings were used (Catts & Kamhi, 2005; Flowers, Meyer, Lovato, Wood, & Felton, 2001). Specifically, preference was given to children diagnosed with specific reading retardation (Catts & Kamhi, 2005) on the basis of a higher IQ.

Recently, Tunmer and Chapman (2007) provided empirical evidence arguing against the premise of the discrepancy definition when they tracked phonological processing, language and reading skills for 91 children over the first three years of formal schooling. Poor readers selected on the basis of being discrepancy-defined or non discrepancy-defined, all had phonological processing deficits. Alarming, Fletcher et al. (1994) suggests that the discrepancy definition model favours a "wait-to-fail" approach because poor readers are not identified until mid-primary level (Catts & Kamhi, 2005; Flowers et al., 2001; Jenkins & O'Connor, 2002; Lyon, Shaywitz, & Shaywitz, 2003). A wait-to-fail approach is contrary to evidence supporting the benefits and critical importance of early intervention.

The rise of the dimensional model

The dimensional model, which is now favoured by many researchers (Fletcher et al., 1994; Siegel, 1989; Stanovich, 1999; Stanovich & Siegel, 1994), argues

that reading difficulty is determined along dimensions of reading, without relying "... too far on other domains of cognitive functioning" (Stanovich, 1999, p. 2). The dimensional model attempts to include features that characterize the reading difficulty alone without relying on factors that must be excluded (Catts & Kamhi, 2005). The SVR framework is one such example that explains processes underlying reading comprehension. The model has regained momentum and empirical support (Catts et al., 2006; Nation et al., 2004; Rose, 2006; Stuart, 2005; Tunmer & Chapman, 2007), after being introduced in 1986 by Gough and Tunmer. In its capacity to explain reading difficulties along both phonological and non-phonological domains of language, the SVR is useful for both assessment and intervention planning. Despite the emphasis on phonological processing in recent literature, the SVR underscores the value of considering oral language alongside phonological processing, rather than simply viewing the two constructs as inextricably linked.

The simple view of reading

The SVR states that reading ability (R) is a product of word level decoding (D) and language comprehension (C) or $R = D \times C$ (Gough & Tunmer, 1986; Hoover & Gough, 1990). Importantly, although the two elements that comprise the SVR call upon dimensions of oral language, decoding relies primarily on phonologically based skills while comprehension relies on language skills other than phonology (Nation et al., 2004), such that both word reading and language comprehension can contribute distinctly to reading comprehension (Savage, 2001). Figure 2 represents the four broad types of reading difficulty for children based on the SVR (Catts & Kamhi, 2005; Stuart,

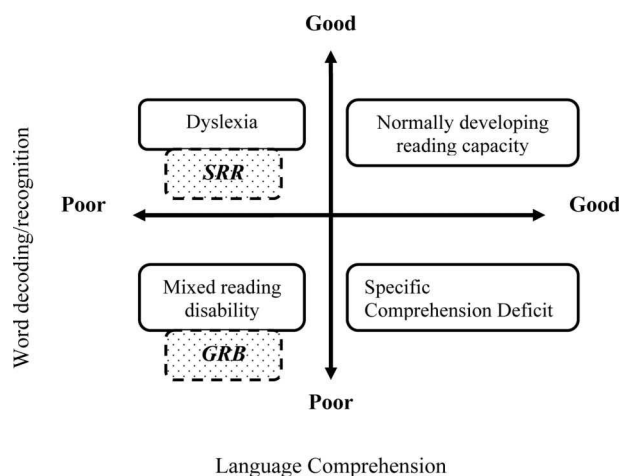


Figure 2. Reading outcomes (Catts & Kamhi, 2005; Stuart, 2005) based on the Simple View of Reading (Gough & Tunmer, 1986). Labels in solid boxes are drawn from the Simple View of Reading model. Labels in broken-linked boxes refer to terminology based on the discrepancy definition model. SRB: Specifically reading retarded; GRB: General reading backwardness.

2005). Table I which follows, explains each type of difficulty according to the underlying deficit.

Catts et al. (1999) provided empirical support for the SVR in their exploration into the language bases of reading difficulty. In their epidemiological study, 183 second grade children classified as poor readers, displayed deficits consistent with the four dimensions of the SVR (see Figure 1). From their cohort of poor readers, Catts et al. (1999) identified 14.3% with phonological processing deficits, 21.9% with oral language processing deficits, 37.2% presented with difficulty across both domains and 26.6% had neither phonological or oral language deficits, but were still performing poorly on tests of reading.

Language predictors of the at-risk reader

Two key points of agreement dominate the literature with regards to language predictors for the at-risk reader. Firstly, the link between phonological processing capacity and learning to read is unreservedly strong (Anthony, Williams, McDonald, & Francis, 2007; Gillon, 2004; Van Kleeck et al., 1998) and as such, features widely as a tool for predicting at-risk children (Catts et al., 2001; Gilbertson & Bramlett, 1998; Jenkins & O'Connor, 2002; Plaza & Cohen, 2003, 2007; Snow et al., 1998; Torgesen, 1998). Secondly, the complex relationship between non-phonological language skills and early reading skills is widely accepted (Boudreau & Hedberg, 1999; Catts et al., 2001, Catts et al., 2006; Plaza & Cohen, 2003, Snowling et al., 2000; Stuart, 2005; Swanson et al., 2005; Vellutino et al., 1991), especially in relation to reading comprehension (Catts et al.,

2002; Hoover & Gough, 1990; Snowling et al., 2000; Van Kleeck, 2007).

A substantial amount of attention has been directed to phonological processing issues in the literature, in relation to reading and reading difficulty. This has led researchers to formulate the phonological-core-deficit hypothesis. The hypothesis argues that breakdown in phonological processing is the primary cause of word reading difficulties (Bradley & Bryant, 1983; Compton, Defries, & Olson, 2001; Liberman et al., 1989; Stanovich & Siegel, 1994; Vellutino et al., 1991). In response, Catts and Kamhi (2005) point out that the non-phonological aspects of language risk getting overlooked as key indicators for predicting reading outcomes.

Despite the web of interactions between reading and its likely language predictors, the "perfect" system has not been found. Issues of over or under identification have not been resolved and results of various investigations into predictive factors have been inconsistent (Jenkins & O'Connor, 2002). This is due in part to methodological factors across studies, such as the use of a variety of formal measures, different ages of sampled children and testing occurring at different times in an academic year. Nevertheless, there is converging agreement that for younger children, letter knowledge and phonological processing tasks are vital in predicting word reading (Catts et al., 1999, 2001; Jenkins & O'Connor, 2002; McNamara et al., 2005; Torgesen, 1998). Further, oral language skills outside the phonological domain also hold predictive power, particularly for reading comprehension (Bishop & Adams, 1990; Catts et al., 1999; Justice et al., 2002), despite the fact that phonological skills have dominated much

Table I. Reading difficulty subtypes.

Reading Difficulty Subtype	Descriptors based on the SVR	Basis of Deficit	Key presenting features	Alternate names for reading difficulty subtype
Dyslexia	Poor WR ¹ Good LC ²	Phonological Processing	Children have poor word reading skills and adequate oral language comprehension.	Poor decoders ³ Specific Reading Retarded ⁴ Phonological and Surface Dyslexia ^{5,9} Phonological deficit hypothesis ⁶ Poor comprehenders ^{3 * 7} Hyperlexia ⁹
Specific Reading Comprehension Deficit	Poor LC Good WR	Listening Comprehension (oral language)	Children can decode and recognize words but fail to understand text effectively ⁸ .	
Mixed Reading Difficulty	Poor LC Poor WR	Phonological processing and listening comprehension	Children have poor decoding skills and poor listening comprehension capacity.	General Reading Backwardness ⁴ Language Learning Disabled ¹⁰ Non-Dyslexic poor reader ¹¹
Non-specified	Good LC Good WR	Unknown	Children have poor reading comprehension in the absence of word reading or language comprehension difficulty.	

Notes: ¹WR: Word Reading, ²LC: Language Comprehension, ³Cain, Oakhill and Bryant (2000), ⁴Rutter and Yule, (1975), ⁵see Coltheart, (2005), ⁶ Stanovich, (2000), ⁷Catts et al., (2006), ⁸Cain, Oakhill and Bryant, 2000, ⁹Aram, (1997), ¹⁰Catts, Hogan and Fey (2003), ¹¹Tunmer and Chapman (2007) * There is some confusion in the literature about the term "poor comprehenders" For example, Cain et al., (2000) use this to mean children with poor reading comprehension and good word reading skills. Catts and colleagues (Catts & Kamhi, 2005; Catts et al., 2006) use the same term to imply both spoken and reading comprehension impairment. As such, they prefer the term "specific reading comprehension deficit" to mean what Cain et al., (2000) refer to as "poor comprehenders". We have used the term from here on in according to Catts and colleagues.

recent literature (Catts et al., 1999; Catts & Kamhi, 2005) in relation to reading difficulty.

The section below explores aspects of language that have been reported in recent literature, as having some capacity to foreshadow reading outcomes. In accordance with the SVR, we have split predictors into the broad categories of phonological processing predictors and non-phonological language predictors. Rationales underpinning the inclusion of various predictors are provided.

Phonological processing

Phonological processing refers to the ability to perceive, store, retrieve and manipulate sounds for both oral and written language (Wagner & Torgesen, 1987). Table II summarises the components of phonological processing. Anthony et al. (2007, p. 114) divide phonological processing into phonological awareness, phonological memory and efficient "... phonological access to lexical storage ...". The last component is otherwise referred to as rapid automatic naming (Anthony et al., 2007; Betourne & Friel-Patti, 2003; Catts et al., 1999; Wagner & Torgesen, 1987). A number of authors have demonstrated that children with reading difficulty frequently display deficits in phonological processing (Snowling et al., 2000; Stanovich, 1999; Wagner & Torgesen, 1987; Vellutino et al., 1991). The predictive capacity of each dimension of phonological processing is discussed below.

The predictive value of phonological awareness

Phonological awareness is the child's foundation skill in word analysis (Yopp, 1992), having closely connected links with mastery of the alphabetic code (Henry, 1993; Wagner & Torgesen, 1987) and the ability to decode words (Anthony et al., 2007; Betourne & Friel-Patti, 2003; Catts & Kamhi, 2005). Phonological awareness comprises the capacity to notice at an auditory level, that individual words are made up of smaller units such as syllables, onset-rime units and phonemes (Catts & Kamhi, 2005). As such, phonological awareness does not require specific knowledge of letters. Phonological awareness should not be confused with 'phonics' which involves knowledge of the letter-sound correspondences (Hempenstall, 2005; Henry, 1993).

A large amount of evidence has now been accumulated to support that the more knowledge children have about the constituent sounds of words, the better they tend to acquire reading skills (Adams, 1990; ASHA, 2001; Goswami & Bryant, 1990; Wagner & Torgesen, 1987), in particular, with word attack skills (Betourne & Friel-Patti, 2003; Plaza & Cohen, 2007). Furthermore, studies have demonstrated that poor phonological awareness is a feature for many children who present with reading difficulty (Ball & Blachman, 1991; Fletcher et al., 1994), such

that Catts and Kamhi (2005, p. 130) claim that there is "... compelling evidence" regarding the importance of phonological awareness as a prerequisite for learning to read.

Support for the capacity of phonological awareness to predict success in reading has been provided by a number of researchers (Catts et al., 1999, 2001; Engen & Høien, 2002; Gilbertson & Bramlett, 1998; Lonigan, Burgess, & Anthony, 2000; Torgesen et al., 1994). For example, Torgesen et al. (1994) found that children who were successful at performing phonological awareness tasks, learnt to read words with greater ease than those who were unsuccessful. These researchers tested phonological awareness, as well as pre-reading and general verbal skills in 288 5-year-old kindergarten children. Performance on tests of phonological awareness in kindergarten (identifying sounds within presented words) was found to be strongly related to reading development in both first and second grade, even when controlling for verbal and pre-reading abilities measured at kindergarten.

The predictive value of rapid automatic naming

For some time now, rapid automatic naming (RAN) has also held status as a predictor of reading skills (Anthony et al., 2007; Catts et al., 2001, 2002; Georgiou et al., 2006; Meyer, Wood, Hart, & Felton, 1998; Plaza & Cohen, 2003, 2007; Simpson & Everatt, 2005; Torgesen et al., 1994; Wolf, 1999). RAN is a measure of "... how quickly children can name continuously presented and highly familiar visual stimuli" (Georgiou et al., 2006, p. 199). As such, RAN is a multi-factorial skill (Plaza & Cohen, 2007) that requires the child to access lexical and phonological information rapidly and efficiently (Betourne & Friel-Patti, 2003; Plaza & Cohen, 2007).

Since Denckla and Rudel (1976) reported that a slow rate of rapid naming correlated with poor reading skills, RAN has repeatedly been shown to distinguish poor readers from average (Georgiou et al., 2006), particularly in the early years of school (Anthony et al., 2007; Meyer et al., 1998). In an epidemiological study exploring reading outcomes for 570 kindergarten children with language impairment, Catts et al. (2001) found that RAN was one of five variables that uniquely predicted reading outcomes in second and fourth grade. More recently, Plaza and Cohen (2007) examined the predictive value of naming speed, among other skills, on reading and spelling tasks in 75 French speaking children. Children were tested at the end of kindergarten and again, at the end of grade one on a series of measures. Naming speed was a strong predictor for word reading accuracy. Plaza and Cohen (2007, p. 74) extend the views of previous researchers by suggesting that naming speed is "... more correlated with speed of word identification", arguing that efficiency in naming speed is an

important precursor to being able to "... detect and represent orthographic patterns".

The double-deficit hypothesis. Wolf (1999) reported the double-deficit hypothesis when she argued that naming speed and phonological awareness skills, contribute separately to reading capacity. The double-deficit hypothesis states that children with poor reading may present with naming speed difficulty alone, phonological awareness difficulty alone or both. In their epidemiological study, Catts et al. (1999) provided evidence to support Wolf's assertion. Poor second grade readers in Catts et al. (1999), substantially outnumbered good readers as having deficits in phonological awareness and rapid automatic naming at kindergarten. Yet within the group of poor readers, 26% had deficits in phonological awareness alone, 16% had deficits in RAN alone and 29% met the criteria for the double-deficit hypothesis. Furthermore, Compton et al. (2001) provide additional support for the double-deficit hypothesis when they classified 476 reading-impaired children and adolescents, as having a single deficit in either RAN or phonological awareness or a double-deficit in both. Not surprisingly, children with either single deficit significantly outperformed the double-deficit children on reading and spelling measures. Those with a double-deficit resembled children with a single deficit in phonological awareness on tasks of word identification whereas the double-deficit children resembled the single-deficit RAN children, on tasks requiring a "speeded/fluent response" (Compton et al., 2001, p. 147). Taken together, recent evidence verifies the value in considering phonological awareness and RAN as separate entities at the outset, since both aspects can uniquely contribute to reading capacity.

The predictive value of phonological memory capacity

Phonological memory, otherwise referred to in the literature as verbal working memory (Gathercole & Baddeley, 1993), comprises the ability to encode, hold and retrieve sound-based linguistic information for short periods of time (Anthony et al., 2007). Betourne and Friel-Patti (2003) summarize research suggesting that poor encoding of phonological material puts the child at risk of having inferior phonological representations and difficulty decoding phonological sequences. Furthermore, Catts et al. (2001) identified sentence imitation at kindergarten level, as one of five variables that uniquely predicts reading capacity at second grade. Taken together, the evidence suggests that weakness in phonological memory at an early age, may contribute to fragile phonological representations and in turn, word decoding difficulty. Phonological memory has attracted less attention in the literature as a predictor of reading outcomes when compared to other phonological processing components. Nevertheless,

empirical evidence, particularly the use of sentence imitation by Catts et al. (2001), indicates that phonological memory warrants consideration, when identifying at-risk readers.

A final word on phonological processing

One of the most significant publications regarding predictors for reading success amongst pre-school children is the Catts et al. (2001) cohort study that was briefly referred to above. A substantial proportion of their findings reinforce the critical importance of phonological processing as a predictor of reading achievement. Catts et al. (2001) assessed 604 kindergarten children on a battery of language, early literacy and non-verbal cognitive tests, and followed the children up two years later. At this second point, children were classified according to whether they demonstrated reading difficulty or not. Using a logistic regression analysis, five variables were shown to uniquely predict reading capacity at second grade. The variables were: letter identification; sentence imitation; phonological awareness (using a syllable or phoneme deletion task); rapid naming (Catts, 1993, cited in Catts et al., 2001) and mother's highest level of education. Three of these five variables reflected phonological processing: phonological awareness, rapid naming and phonological memory. Of the remaining two variables reported by Catts et al. (2001), letter identification reflects alphabetic coding and maternal education reflects an environmental factor.

All told, the evidence for the importance of phonological processing components as requisite skills for reading is strong. It is, according to Pearson (2004, p. 225) "... a necessary but not a sufficient condition for the development of decoding and reading". As such, its status as a valuable predictor for identifying at-risk readers is justified. Speech-language pathologists can examine phonological processing in preschool and school aged children of all abilities since by definition, alphabetic knowledge is not required to complete tasks.

The predictive value of oral language skills

The link between non-phonological aspects of language skills (i.e., semantics, syntax and morphology) and reading achievement has been well established for some time and remains so (Bradley & Bryant, 1983; Catts et al., 1999, 2002; Fletcher et al., 1994; Georgiou et al., 2006; Goswami & Bryant, 1990; Tunmer & Chapman, 2007; Vellutino et al., 1991; Van Kleeck, 2007). The significance of oral language ability, particularly receptive language as a key requisite for reading, is aptly illustrated by the SVR. The SVR postulates that listening comprehension is a critical determinant and unique contributor to reading comprehension (Gough & Tunmer, 1986). The SVR rests on the assumption that once written information has been decoded, the reader

uses strategies to make sense of the written information in the same way as if it was presented auditorily (Gough & Tunmer, 1986; Vellutino et al., 1991).

Vellutino et al. (1991) provide empirical support for the SVR with specific reference to the delicately balanced relationship between language skills (phonological and non-phonological aspects) and reading comprehension. Based on an oral reading task, Vellutino et al. (1991) classified the reading ability of 116 “younger” and “older” children (grades 2 and 3 along with grades 6 and 7 respectively), as “severely impaired”, “moderately impaired”, “average” or “good” readers. A range of language, reading and cognitive assessments were then administered, in part to determine the predictive capacity of various linguistic and cognitive tasks on reading comprehension. In accordance with the SVR, Vellutino et al. (1991) reported that listening comprehension and word identification abilities were most powerful skills when predicting reading comprehension. Interestingly, word identification was more predictive in younger and/or less skilled readers for reading comprehension, while listening comprehension was more predictive of reading comprehension for older and/or normally developing readers. Put simply, Vellutino et al. (1991) demonstrated that word identification ability and listening comprehension ability are weighted differently at different developmental points, when predicting reading comprehension. As children in Vellutino et al. (1991) approached mastery in word identification (namely the normally developing and/or the older children), listening comprehension took on a more predictive role as a determinant of reading capacity. Since reading comprehension was notably lower than listening comprehension for only the young and less able readers, Vellutino et al. (1991) suggest that convergence in reading and listening comprehension, occurs only with increasing capacity in word identification. This progressive convergence of listening and reading comprehension ability, mediated by word identification ability, further highlights the sensitive connections between oral and written language.

Oral language and later reading outcomes

As an alternative to the unitary phonological-core hypothesis, the integrative hypothesis of reading proposes that linguistic skills beyond the phonological domain make unique contributions as foundations to reading (Plaza, 2003; Plaza & Cohen, 2003). Two longitudinal studies provide empirical evidence, supporting the intuitions of many, that the presence of language deficits in the preschool years renders a child far more likely to experience reading difficulty during formal education (Catts et al., 2002; Snowling et al., 2000). Both studies tracked reading ability and language skills of preschool, language-impaired (LI) and typically developing children, as they progressed through school. Both groups of

investigators reported substantially poorer performances in reading capacity, particularly in reading comprehension, when the LI children were compared to the controls at the various testing points.

Reading outcomes of young language-impaired children: Some key evidence

In their epidemiological study, Catts et al. (2002) reported significantly depressed reading performances for the LI group when tested at grade 2 and grade 4. Importantly, Catts et al. (2002) emphasise that not all LI children progressed to experiencing reading difficulty. Using the 16th percentile as a cut-off point, 52.9% and 48.1% of the LI kindergartners had reading difficulty at grades 2 and 4 respectively. This compares with 8.6% and 8.2% in the normally developing control group. Further, the researchers report a relationship between the degree of language impairment at kindergarten and reading achievement in the school years. Those with more severe language difficulties were more likely to have poorer outcomes in reading. Children who remained LI at either one or both follow-up assessment points, had poorer reading outcomes compared to those children who were no longer classified in that category. Nevertheless, children who no longer met the criteria for LI, still performed significantly more poorly on reading tasks than their matched controls.

Snowling et al. (2000) served to further clarify the interrelationship between oral language and reading by following a group of “specifically language impaired” (SLI) preschoolers, diagnosed at age four, into their adolescence. As part of a larger epidemiological study (see Bishop & Edmundson, 1987), the children with SLI identified by Snowling et al. (2000) were tested at the ages of 5.5, 8.5 and 15 on language and literacy measures. These data were compared with a control group of children without SLI. Eighty-seven children were diagnosed with SLI in the initial phase (1987) and 56 of these children were still participants at age 15 (2000). At 15, the group with SLI was overrepresented as having difficulty on various measures of reading when compared to the control group. Of note, reading accuracy measures had dropped considerably since measures taken at 8.5. At ages 8.5 and 15, the group with SLI performed poorly on reading comprehension. However, reading accuracy had also become problematic for 41% of the SLI cohort at age 15. As such, many of the 15-year-olds from the SLI group had more than a specific comprehension deficit alone.

Snowling et al. (2000) suggest that phonological processing may still be at the core of reading difficulty for SLI children despite the fact that their trajectory towards reading difficulty is different to young children presenting primarily with phonological impairments. On the basis of the decline in reading accuracy as children moved into adolescence, Snowling et al. (2000) suggest that the

phonological difficulties declare themselves well after basic alphabetic mastery. They propose that the core phonological deficit takes effect later on, as the child attempts to build connections between orthography and phonology for ongoing development of word recognition. Since this process of making connections between orthography and phonology relies on the use of vocabulary knowledge and sentence context (Snowling et al., 2000), children with SLI are likely to be at a disadvantage.

Data presented by Snowling et al. (2000) provide confirmatory support for the links between LI and reading difficulty. Their findings also forewarn the practitioner that phonological processing difficulties may impact upon a child's reading beyond the initial phase of learning to read.

Poor comprehenders

Recently, a number of authors have turned their attention to children now referred to as "poor comprehenders" (Cain et al., 2000; Cain, Oakhill, Barnes, & Bryant, 2001; Catts et al., 2006; Nation et al., 2004), otherwise referred to as children with a specific comprehension deficit (Catts & Kamhi, 2005) (see Figure 2). Reading difficulty for poor comprehenders, is characterized by impaired text comprehension despite intact phonological processing (Cain et al., 2000), and fluent, accurate word reading capacity (Catts et al., 2006; Nation et al., 2004). As such, the basis of a specific comprehension deficit cannot be explained by the phonological-core-deficit hypothesis. Furthermore, strength in phonological processing separates poor comprehenders from many children diagnosed with specific language impairment (Catts et al., 2006; Nation et al., 2004). Importantly, both Catts et al. (2006) and Nation et al. (2004) anecdotally report that poor comprehenders tend to be overlooked by classroom teachers. In turn, these children are far less likely to be referred to speech-language pathologists or related colleagues. Furthermore, Catts et al. (2006) report that although LI was common for many of their eighth grade poor comprehenders when they were in kindergarten, only about one-third of these children with LI actually met criteria for SLI classification at the time. It would seem that the majority of poor comprehenders had a sub-clinical LI as preschoolers. Nevertheless, evidence demonstrates that school-aged poor comprehenders perform significantly less well on measures of non-phonological aspects of language, but similarly on phonological processing measures (Cain et al., 2000; Catts et al., 2006; Nation et al., 2004). Taken together, it would seem prudent for kindergarten children in this sub-clinical category to be closely monitored as they progress through school.

Although, the literature has drawn a line between the basis of reading difficulties of the SLI children and poor comprehenders, investigators of the poor comprehenders have typically not tracked their

reading performance into adolescence as Snowling et al. (2000) did. It should be noted that Catts et al. (2006) identified their cohort at eighth grade, and tracked data retrospectively. It remains to be seen whether the poor comprehenders follow a similar trajectory to that reported by Snowling and colleagues.

Language domains

We have explored evidence highlighting non-phonological aspects of oral language deficits as key determinants for reading difficulty. Given that non-phonological language itself comprises a number of components, it is worth noting that some investigators have reported that deficits in particular language domains can better predict later reading difficulty. To demonstrate, there is evidence that poor grammar (Catts et al., 2002; Nation et al., 2004; Plaza & Cohen, 2003), semantics (Catts et al., 2006; Vellutino et al., 1991) and discourse comprehension (Catts et al., 2006) all relate to later reading difficulty. There is some debate however. For example, Vellutino et al. (1991) argue that semantic skills play a more important role than grammatical competency, yet Catts et al. (2002) report that their grammar composite was more closely associated with reading outcomes than other language domain scores.

Differing trajectories for reading difficulty

As a result of exploring the language bases of reading difficulty, it is apparent that the likely trajectory of reading difficulty is reliant on the nature of the language breakdown. Further, it is possible that there will be periods of apparent success in learning to read because of compensation by an area of relative linguistic strength over another area of weakness. This illusory success can be misleading and may explain how some children may get overlooked.

Table II. Phonological Processing: Key components and examples.

Component of phonological processing	An example of the component
Phonological awareness ^a	Detecting the first sound in a word Determining the number of syllables in a word Detecting rhyming components of words
Accessing phonological name codes (Rapid Automatic Naming)	Ability to rapidly name familiar stimuli such as letters or numbers
Memory for phonological stimuli (Memory for verbal information)	Ability to repeat a series of information (typically nonsense words, strings of numbers, phrases of increasing length etc) presented auditorily

Note: ^aPhonological awareness is achieved at the syllable, onset-rime or phoneme level (Gillon, 2004).

Table III. Mapping the predicted trajectory for reading difficulty for children with different areas of language breakdown.

Primary area of language breakdown	Phonological processing difficulty		SLI		Language difficulties – possibly sub-clinical	
	Language difficulties primarily in the phonological domain.		Language difficulties are primarily outside the phonological domain.		Language difficulties are in the non-phonological domain.	
Initial progress learning to read in formal education	Poor capacity to develop foundation skills for phonological representations and word decoding.		Decoding and alphabetic skills develop as phonological processing ability is sufficiently able to support early word recognition.		Decoding and alphabetic skills develop as phonological processing ability is sufficiently able to support early word recognition.	
Trajectory in early formal education	Children rely on orthographic word representations; thus “appearing” successful in learning to read.		When text level processing demands are low, comprehension appears intact. Word recognition remains a strength.		When text level processing demands are low, comprehension appears intact. Word recognition remains a strength.	
Basis of reading breakdown	Poor facility in word decoding, identification and recognition such that efforts cannot be efficiently directed to comprehending text.		Once text level processing demands increase, non-phonological language constraints impact on reading comprehension.		Once text level processing demands increase, non-phonological language constraints impact on reading comprehension.	
Further breakdown possibilities	Reliance on orthographic representation capacity is difficult to sustain as reading demands increase; simply because of the volume of words that must be read and processed.		High level phonological processing deficits may surface some time after alphabetic mastery, as the child attempts to build word recognitions skills via orthographic and phonological connections.			
Result	Poorly developed word recognition results in effortful reading; thus using up valuable resources that should otherwise be put to processing the text.		After initial “success” difficulties apparent in reading comprehension and possibly in word recognition as demands on text level processing and word reading accuracy increase.		“Poor comprehenders” After initial “success”, compromised reading comprehension due to language processing limitations.	

Nevertheless, assuming the ultimate aim of reading is to gain meaning from written text (Jenkins & O'Connor, 2002), children with unresolved language difficulties will end up with reading comprehension breakdown. Based on what we have discussed, Table III has been constructed to demonstrate the likely pathway through reading difficulty for children presenting with phonological and non-phonological language deficits. Although it is somewhat artificial to assume that language breakdown occurs in discrete domains as Table II suggests, it maps the likely course and discusses mediating factors.

Conclusion

In this review, we have assembled evidence from previous research regarding the predictive power of phonological and non-phonological aspects of language. In doing so, we have further reinforced that difficulties with reading very often have their foundations in spoken language skills. Accordingly, we concur with previous authors (ASHA, 2001; Boudreau & Hedberg, 1999; Gilbertson & Bramlett, 1998; Justice et al., 2002) that speech-language pathologists have a critical role in the identification of at-risk readers. In 2001, ASHA's Ad Hoc Committee on Reading and Writing highlighted that speech-language pathologists' intimate knowledge across all language components, positions them to play a crucial role in preventing reading difficulty as well as assessing, diagnosing and supporting young at-risk readers. Importantly, Boudreau and Hedberg (1999) drew attention to the fact that speech-language pathologists are very often the first specialist to have contact with preschool children who may have language difficulties. Taken together, we argue that speech-language pathologists can and should play a vital mediating role for preschool and early school aged children as part of an early identification programme for at-risk readers. Ideally, we propose that speech-language pathologists, in collaboration with their professional colleagues, could be part of a prevention programme. However, establishing the speech-language pathologist's role in early identification is a useful starting point.

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